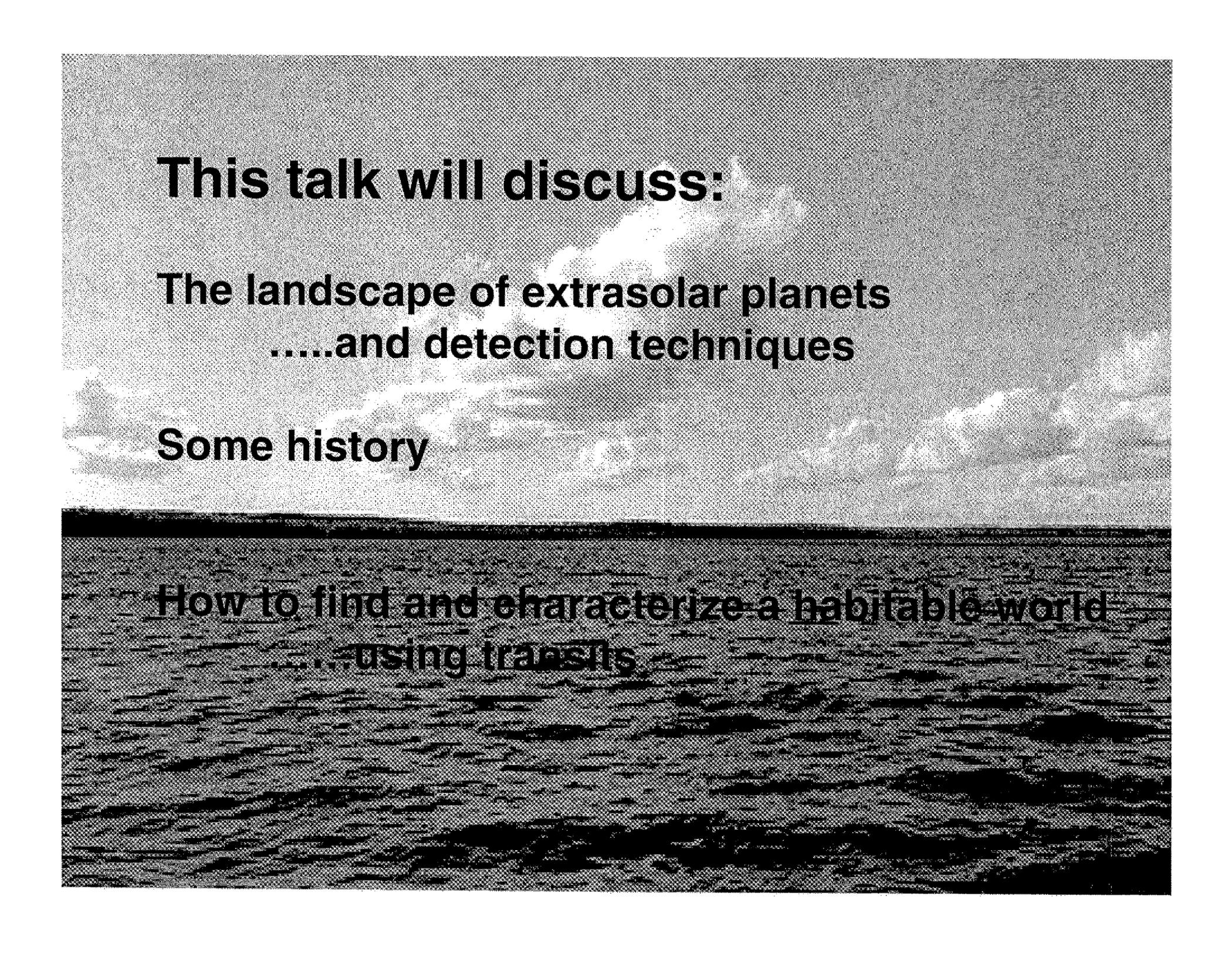


*Exploring a Nearby Habitable World
.... Orbiting an M-dwarf star*

Drake Deming
NASA's Goddard Space Flight Center



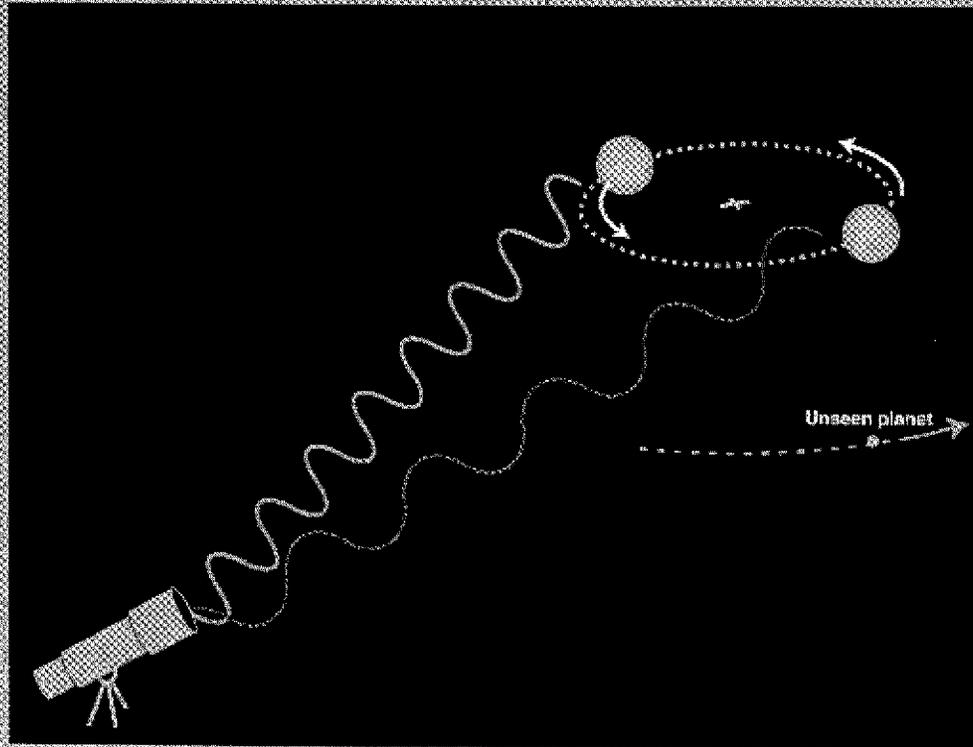
This talk will discuss:

**The landscape of extrasolar planets
.....and detection techniques**

Some history

**How to find and characterize a habitable world
.....using transits**

Most of the > 450 exoplanets have been detected using radial velocities

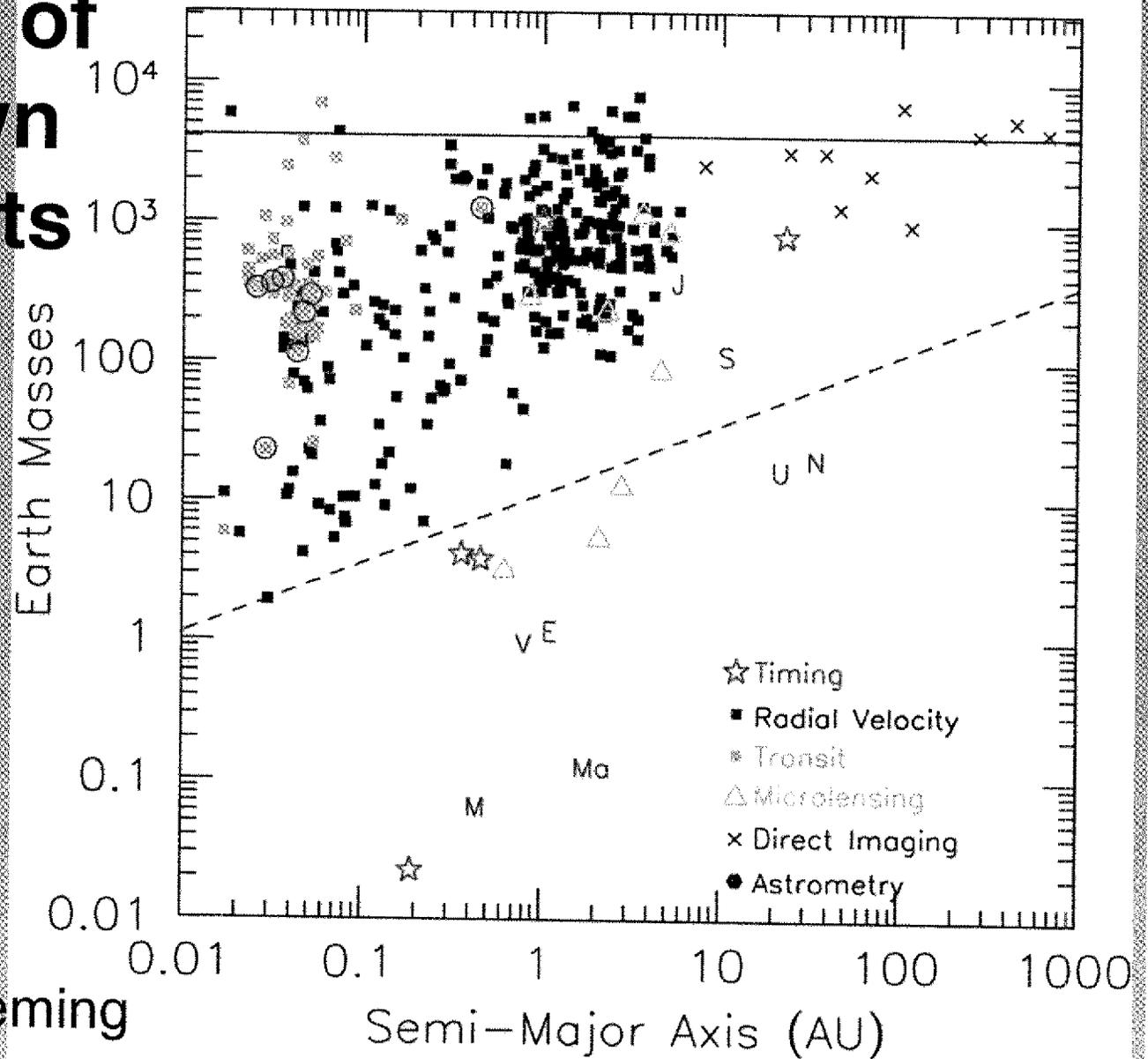


**...an *indirect* detection:
light from the planet is not measured**

Summary of the known exoplanets

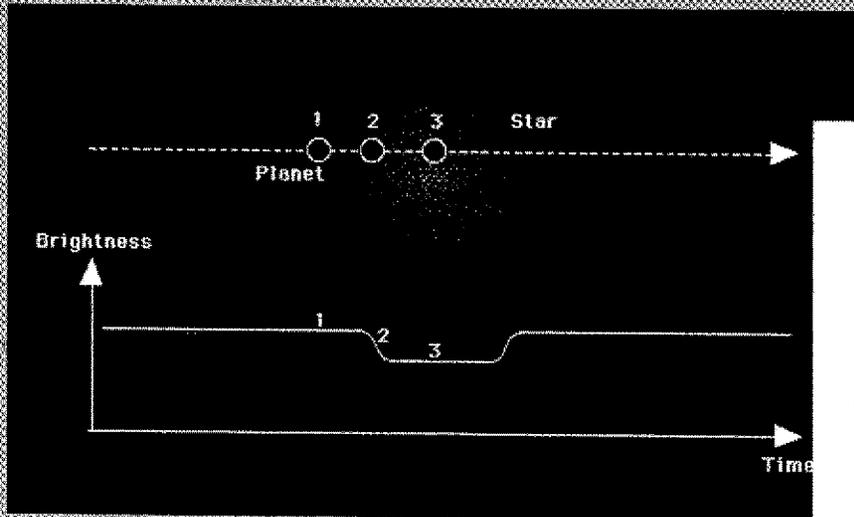
Deming & Seager
review in Nature
462, 301 (2009)

Also, Seager & Deming
ARAA (2010)



Exploit transits to characterize SuperEarth Atmospheres...

Direct detection of light from the planet



The diagram illustrates a planet orbiting a star. A large arrow indicates the direction of the planet's orbit. Two positions are shown: 'Transit' where the planet passes between the star and the observer, and 'Eclipse' where the planet passes behind the star. A small globe representing Earth is shown receiving light from the star. A wavy arrow indicates radiation from the planet.

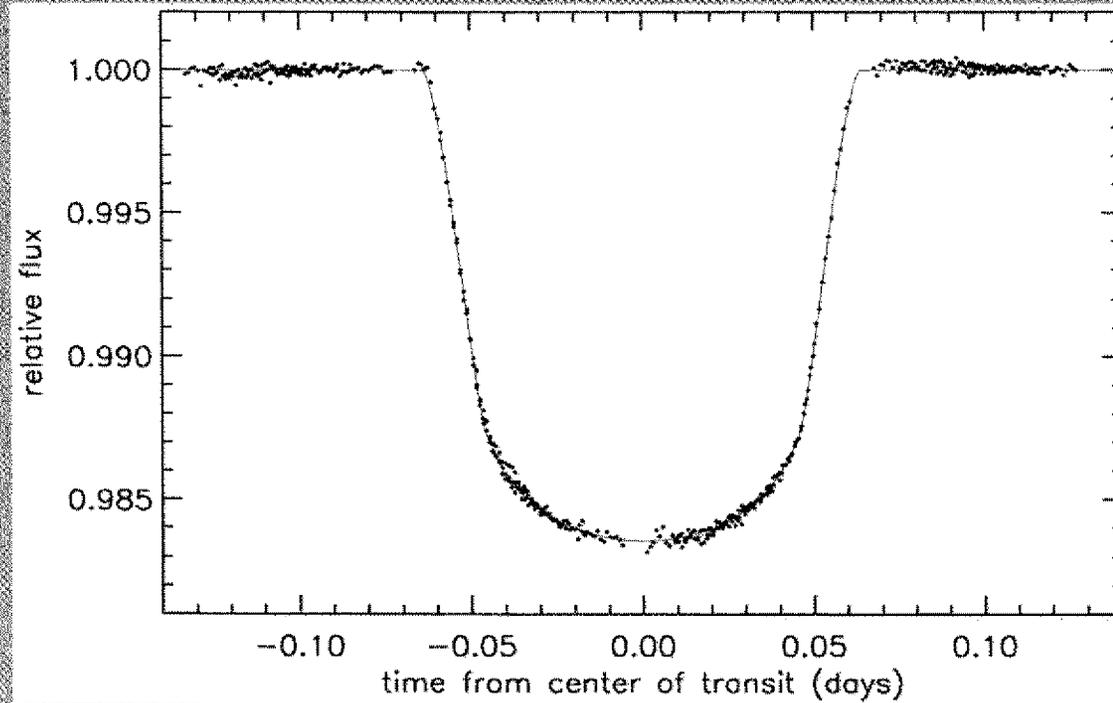
See thermal radiation from planet disappear & reappear

Measure size of transiting planet, see radiation from star transmitted through the planet's atmosphere

Gravitational tug of unseen planets alters transit times

TRA0009

Can we characterize the atmosphere of a SuperEarth using transits...? A habitable one??

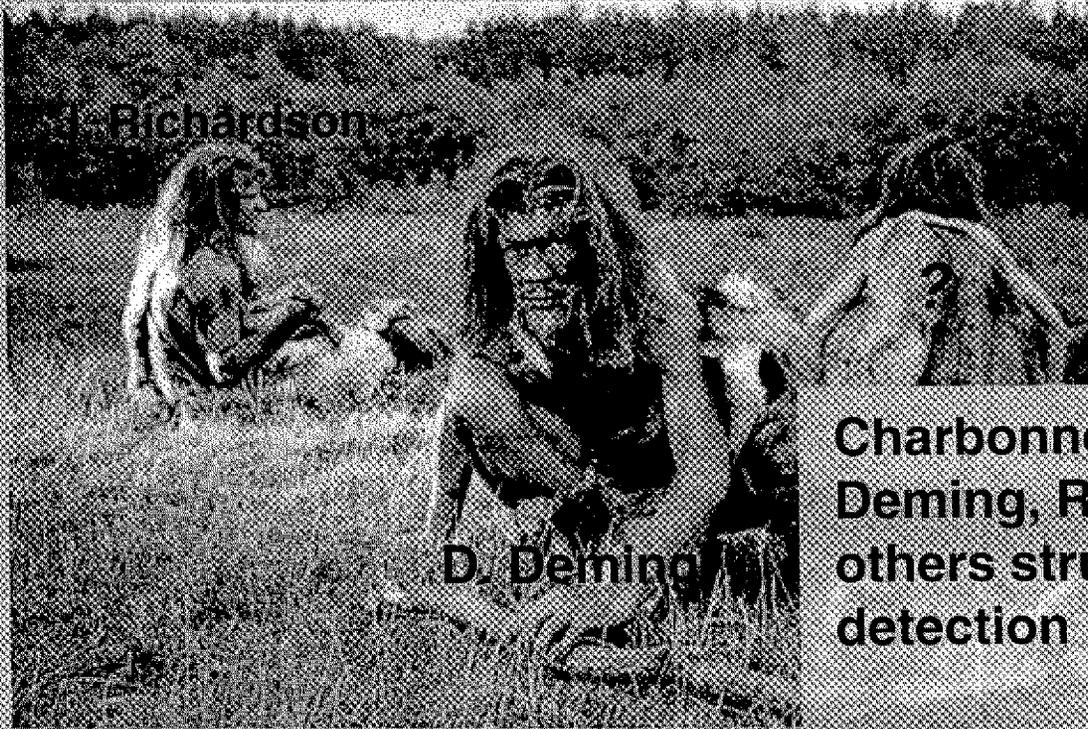


Brown et al. 2001, ApJ 552, 699

Transit data immediately yield the planet's bulk properties - mass ($0.69 M_J$) and radius ($1.35 R_J$)

➡ Can we characterize the atmosphere?

Emitted/reflected spectra of hot Jupiters in the paleolithic age (1999-2003)



Charbonneau, Brown, Collier-Cameron, Deming, Richardson, Wiedemann, and others struggled towards ground-based detection

